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ACCIDENTS IN FARMING IN SANTA FE PROVINCE, ARGENTINA

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SUMMARY

Background: the frequency of occupational accidents tends to be high in rural areas. **Objectives:** to characterize accidents and injuries, risk perception and adoption of protective elements on livestock workers in Sarmiento, Santa Fe, Argentina. **Methods:** a cross-sectional study was carried out on a random sample of 125 workers. Data was collected by personal interviews using a structured questionnaire. Statistical analysis included χ^2, Spearman rank correlation and logistic regression. **Results**: fifty four percent had suffered at least one occupational accident, being associated with sex ($P= 0.04$), activity within the farm ($P= 0.18$) and years of farm work ($P= 0.02$). Perceptions of risk were highest *in itinere* traffic (92%) and handling of chemicals (85%) but was not correlated with the adoption of safety practices. Correlations between perceptions were highest between the use of machinery and tools ($r= 0.83$, $P< 0.0001$) and the handling of abortions and carcasses ($r= 0.71$, $P< 0.0001$). Wearing gloves was most frequent when handling abortions (61%) and was correlated with their use during parturitions and the handling of carcasses ($r= 0.92$ and 0.94 respectively, $P< 0.0001$). Seat belts and car lights during daytime were mostly used on main roads. **Conclusions**: an intensive educational effort is suggested to minimize the frequency of accidents and maximize the adoption of safety practices.

Key words. Accidents, protective elements, livestock production, risk perception, safety practices.

ACCIDENTES EN TRABAJADORES GANADEROS EN SANTA FE, ARGENTINA

RESUMEN

Antecedentes: la frecuencia de accidentes ocupacionales en áreas rurales es alta. **Objetivos**: caracterizar accidentes y lesiones en la actividad ganadera en una población definida (Sarmiento) en la provincia de Santa Fe (Argentina), percepción de riesgos y adopción de elementos de protección. **Métodos:** el diseño fue transversal con muestreo al azar (n=125) y cuestionario estructurado. El análisis incluyó χ^2, correlación de Spearman y regresión logística. **Resultados**: el 37% de los encuestados no se había sometido a una revisión médica en los últimos dos años y el 50% tuvo ausencias laborales (57,9±106,1 días). Ocho habían sufrido un accidente en los 12 meses previos y el 54% en algún momento de su vida laboral, estando asociados al sexo ($P= 0,04$), relación y antigüedad laboral ($P= 0,02$). Los más frecuentes fueron aprisionamientos o atropellamientos con resultados de contusiones y heridas y localización en piernas, manos y columna. Las percepciones de alto riesgo fueron mayores en tránsito *in itinere* en rutas (92%) y manipulación de agroquímicos (85%) pero no estuvieron correlacionadas con el uso de elementos de protección. Las correlaciones entre percepciones fueron mayores entre el uso de maquinaria y herramientas ($r= 0,83$ $P< 0,0001$) y manipulación de abortos y cadáveres ($r= 0,71$ $P<0,0001$). El uso de guantes fue mayor en manipulación de abortos (61%) estando correlacionado con su uso en partos y manipulación de cadáveres ($r= 0,92$ y 0,94 $P< 0,0001$). El uso de ropa específica, fajas anatómicas, protectores oculares o auditivos fue muy bajo (de 0 a 8%). El cinturón de seguridad y luz baja durante el día fueron más usados en ruta. **Conclusiones:** se sugiere la realización de actividades informativas y formativas para sensibilizar a los trabajadores sobre los riesgos observados y los accidentes más frecuentes.

Palabras clave. Accidentes, elementos de protección personal, producción animal, percepción de riesgos, prácticas seguras.

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INTRODUCTION

The frequency of accidents tends to be high in rural areas and was associated with an increased risk of pesticide poisoning and injuries resulting from contact with animals and machinery (Rodrigues and Silva 1986; Doyle and Moore 1989; Alavanja *et al.*, 1998; Von Essen and McCurdy 1998; Fehlberg *et al.*,. 2001; Soares *et al.*, 2003; Stallones and Beseler, 2003; Boland *et al.*, 2005; Zentner *et al.*, 2005; Zwerling *et al.*, 2005). Scientific evidence in Latin America came from Argentina, Brazil and Costa Rica (De Elizalde *et al.*, 1970; Lopes 1982a; Lopes 1982b; Vieira *et al.*, 1983; Rodrigues and Silva 1986; Navarrete 1989; Álvarez *et al.*, 1990; Faria *et al.*, 1992; Werner 2000; Fehlberg *et al.*, 2001; Gastaldi *et al.*, 2003; Soares *et al.*, 2003; Tarabla 2009). In Argentina, incidence of rural accidents and diseases in livestock workers exceeded the 12.9% of workers, while incidence of deceased workers was 3.4 times greater than the global (SRT 2005).

In the rest of the world, occupational accidents in rural areas have been associated with the number of hours of work and sleep, exposure to large farm animals, educational level, age and sex (Low *et al.*, 1996; Hwang *et al.*, 2000; Pickett *et al.*, 2003; Sprince *et al.*,2003; Stallones and Beseler 2003; Dimich-Ward, 2004; Hagel *et al.*, 2004; McCurdy *et al.*, 2004). In dairy farms, livestock may be responsible for four out of 10 lesions in workers (Waller, 1992).

The evaluation and management of health risks is based on the assumption that risk factors and the chances accidents can be characterize and measured (WHO, 2002). Each individual has their own perception of health risks, which is influenced by their own experience and knowledge (Department of Health UK 1991). No research has been published in Latin America exploring for risk factors, risk perception and adoption of safety practices in livestock production. The objectives of this study were to characterize the accidents and injuries suffered by cattle workers, their risk perceptions and usage of protective elements.

MATERIALS AND METHODS

In order to accomplish our objectives an observational study on accidents, risk perception and uptake of safety practices was carried out in the District of Sarmiento, Province of Santa Fe, Argentina. This area has a total population of 1.563 inhabitants and its economy is based on livestock, especially dairy production. The design was cross-sectional, the unit of interest was the rural worker, the study population the rural workers in Sarmiento District and the reference population the rural workers in the main dairy cattle area of Argentina. Sampling was at random and sample size was determined taking into account an absolute error of 5%, a 95% confidence level and an expected prevalence of 13%. This expected frequency was taken from previously published data in Argentina (SRT 2005). The calculated n (122) was expanded to 125 providing for possible losses of sample units. Surveys were completed in personal interviews conducted by the authors. Respondents previously lectured on the purpose of work, emphasizing that the interest was not focused on the activities or attitudes of any particular person, but on the frequencies at the population level. The identity and address of the respondent were not included in the survey. ''Case'' was defined as a respondent who has suffered at least one accident during a specified period. The frequency was calculated as the number of cases in relation to total number of respondents. Accidents were classified according to the type of lesion(s), anatomical location(s), characteristics (run over, trapped, crash, etc.) and elements involved (animal, machinery, etc.). Days off work were computed as the frequency of respondents with at least one day of absence and the average days of absence from work. The periods under study were: a) the total number of years working in farming and b) the last 12 months preceding the survey.

Five socio-demographic characteristics were taken into account as possible risk factors: sex, years in farming, formal education (primary/ secondary school or higher), type of farm (dairy/ other agricultural activities) and employment status (employee or casual workers/ owner or manager). Length of employment was transformed into an ordinal variable using the percentile 33 (12 years) and 66 (25 years) as cutoff points.

''Perception of risk'' was defined according to the World Health Organization (WHO 2002) as ''the notion of the probability of a subsequent adverse health event'' of the respondent and was measured on an ordinal scale (high/ medium/ low). The frequency of usage of prevention elements was also quantified using an ordinal scale (never/ sometimes/ always) (Tarabla 2009).

Statistical analysis

The analysis of risk factors was conducted in two stages. Firstly, all socio-demographic variables (risk factors) were compared among themselves and with the dependent variable (worker had/ did not have an accident working in farming) using χ^2. Only variables associated with the dependent variable after χ^2 (P<0.20) were offered to the model (Hosmer and Lemeshow, 1989). The estimation method was maximum likelihood with a convergence criterion of 0.01 for a maximum of 10 iterations. Perceptions and use of protective elements were correlated by means of the Spearman Rank Correlation coefficient. All statistical analysis was performed using InfoStat® (Universidad Nacional de Córdoba, Argentina).

RESULTS

Seventy six percent of respondents were men, 76.8% had attended only primary school and 66.4% were employees or casual workers. On average, they had 22.6±15.1 years of exposure to farm tasks. Three percent had never undergone a routine medical examination and 33.6% had not been subject to one in the past two years. Fifty percent had at least one day of absence from work, averaging 57.9±106.1 days. Eight respondents had suffered an occupational accident in the 12 months preceding the survey, namely trapped by animals (n= 2) or machinery (n= 1), to be run over by animals (n= 1) or carriage (n= 1), traffic accident *in itinere* (n= 1), extreme physical effort (n= 1) and heat exposure (n= 1) resulting in bruises, contusions, wounds, fractures, tendon cut or internal injuries. On the other hand, 53.6% had at least one accident since they started working on farming. The most frequents events were being pressed up or hit by cattle and extreme physical effort (Figure 1). The most common injuries were fractures and wounds (Figure 2) in legs,

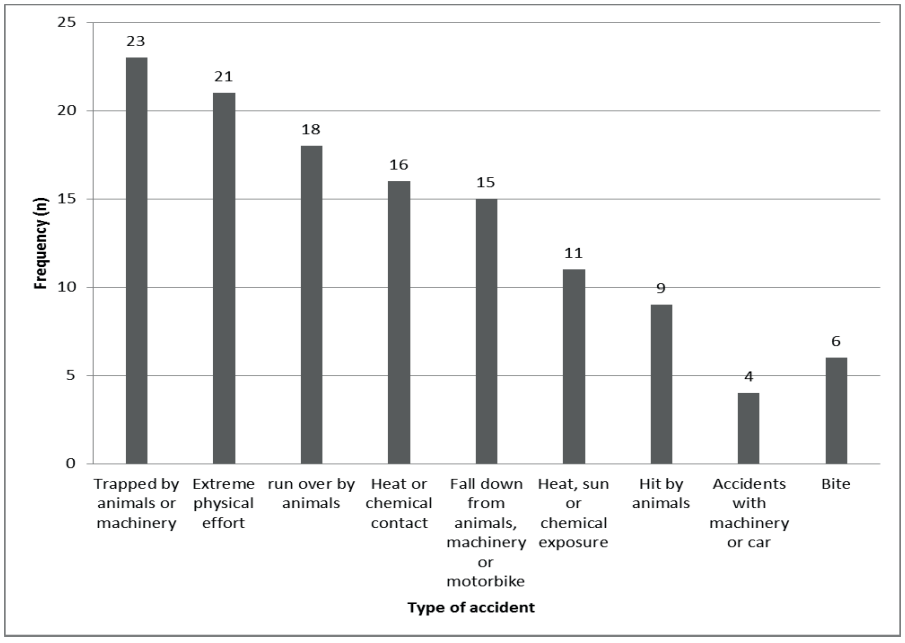

Figure 1. Type of accidents in farming.

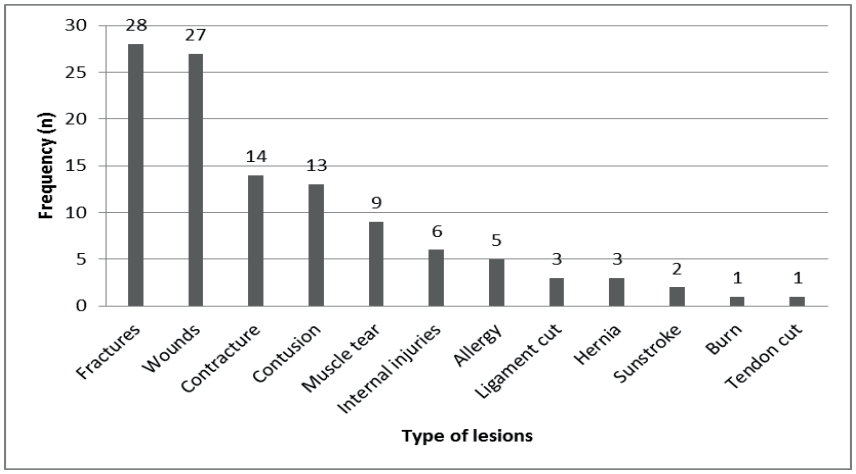

Figure 2.
Type of lesions for accidents in farming.

hands and fingers. Spine lesions were associated to extreme physical efforts. Most frequent illness attributed to farm work was ''lower back pain'' (36.8%).

Risk factors were independent of each other with the only exception of years of exposure to farm tasks and activity within the farm. Owners/ managers had spent more years in farming than employees/ casual workers ($P<0.0001$). After χ^2 test, sex ($P= 0.0329$), schooling ($P= 0.0185$), activity within the farm ($P= 0.1824$) and years of exposure to farm tasks ($P= 0.0617$) met inclusion criteria for logistic regression. The convergence criterion was reached after three iterations (Table 1).

The more years exposed to farm activities the greater the risk of accidents. Men had 2.5 times more risk of accidents than women, while casual workers and employees were 2.7 times more likely to suffer an occupational accident than owners and managers.

The most frequent precautions were taken when handling machinery. The frequency of gloves use was variable, while the use of specific clothing was very low, even when handling abortions or agrochemicals. Seat belts and car lights during the daytime were more used on paved main roads than on dirt rural roads (Table 2).

The frequencies of usage of gloves when handling cattle parturitions, abortions and corpses were highly correlated with each other with coefficients between 0.88 and 0.97 ($P< 0.0001$). However, this was not the case in the use of

Table 1. Logistic regression of risk factors associated with accidents in livestock farming.

Predictive variables		*B*	S.E. [1]	*P*	O.R. [2]	CI 95% [3]
Constant		-0.76	0.90	0.3392	-	-
Sex		0.92	0.45	0.0420	2.52	1.01 – 6.14
Formal education		-0.71	0.47	0.1342	0.49	0.19 - 1.24
Employment status		1.00	0.48	0.0172	2.73	1.06 – 7.04
Years in farming	≥12 < 25 years	0.10	0.46	0.8336	1.10	0.45 – 2.71
	≥25 years	1.28	0.56	0.0237	3.58	1.19 – 10.82

Deviance: 154.44, $P= 0.0160$. Reference Population: Female Sex, Formal education: secondary school or higher, Employment status: owner or manager, Years in farming <12 years. References: [1]Standard Error, [2] Odds Ratio, [3] Confidence Interval.

Table 2. Frequency of usage of prevention elements in livestock farming workers.

Elements	Activity (n)		Frequency (%)		
			Always	Sometime	Never
Gloves	Handling cattle parturitions (107)		41.1	19.6	39.3
	Handling corpses (101)		40.6	16.8	42.6
	Handling abortions (107)		41.1	18.7	40.2
	Handling agrochemicals (57)		26.3	12.3	61.4
	Wire fencing (74)		14.9	13.5	71.6
	Working with grinders (77)		15.6	16.9	67.5
	Handling tools (92)		22,8	18,5	58,7
Mask/goggles	Handling cattle parturitions (101)		0	2.0	98.0
	Handling corpses (97)		0	1.0	99.0
	Handling abortions (120)		0	1.0	99.0
	Handling agrochemicals (58)		1.7	5.2	93.1
	Grain grinding (71)		4.2	11.3	84.5
Specific clothing	Handling agrochemicals (55)		1.8	1.8	96.4
Waist protector	Extreme physical effort (124)		6.5	24.2	69.4
Hearing protection	Noisy activities (117)		7.7	8.5	83.8
Covers	Cover movable parts (96)		63.5	22.9	13.5
Stop the machine	Before checking it up (92)		88.0	10.9	1.1
Manual	Read the instruction manuals before usage (92)		50.0	19.6	30.4
Seat belt	Traffic *in itinere*	Main route (118)	63.6	18.6	17.8
		Dirt rural roads (115)	29.6	21.7	48.7
		Urban (110)	10.9	26.4	62.7
		Rural (112)	6.3	82.6	11.1
Car lights during the daytime	Traffic *in itinere*	Main route (112)	88.4	8.9	2.7
		Dirt rural roads (111)	62.2	28.8	9.0

safety practices with regards to machinery. Wearing seat belts on main roads was weakly associated with its use in rural roads (r= 0.35), while turning the car lights on during daytime on main and rural roads was inversely correlated (r= -0.38). The highest perceptions of risk were associated with the handling of agrochemicals, while transiting on main roads was perceived as more risky than the transiting on rural roads (Table 3).

Risk perceptions on the handling parturitions, abortions and corpses were correlated with each other with correlation coefficients between 0.56 and 0.71 (P< 0.01). Similarly, perceptions about the usage of tools, tractors and other machinery were highly correlated with coefficients between 0.77 and 0.83 (P<0.01). However, only 30.9% of respondents perceived noisy activities as highly risky, and it was independent from perceptions about working with grinders, tractors or other machinery and tools. Finally, frequencies of usage of protective elements were independent from risk perception in any given activity.

Table 3. Risk perception of accidents in livestock farming.

Activity (n)		Risk (%)		
		High	Medium	Low
Handling animals (112)		16.1	65.2	18.8
Handling cattle parturitions (116)		29.3	47.4	23.3
Handling abortions (116)		40.5	44.0	15.5
Handling corpses (118)		33.9	45.8	20.3
Consumption of homemade sausages		8.8	46.4	44.8
Handling agrochemicals (98)		84.5	10.2	5.1
Handling tools (116)		14.7	68.1	17.2
Tractor (115)		21.7	65.2	13.0
Handling machinery (114)		17.5	71.1	11.4
Grain grinding (109)		32.1	51.4	16.5
Noisy activities (123)		30.9	44.7	24.4
Wirefencing (111)		8.1	53.2	38.7
Traffic *in itinere*	Main route (121)	91.7	8.3	0
	Dirt rural roads (122)	34.4	59.0	6.6
	Rural (123)	4.1	38.2	57.7
	Urban (122)	15.6	60.7	23.8

DISCUSSION

Most published studies on rural occupational accidents come from secondary data taken from hospital records (Navarrete, 1989; Cogbill *et al.*, 1991; Waller, 1992; Morrongielo *et al.*, 2007), notification system and accidents records (Lopes, 1982a, b; Kelley, 1994) and death certificates (Vieira *et al.*, 1983). Moreover, primary data has generally been collected during hospitalization of rural injured (Rodrigues and Silva 1986; Soares *et al.*, 2003; Choi *et al.*, 2006; Ferguson Carlson *et al.*, 2006; Akdur *et al.*, 2010). In those cases, the actual frequency of accidents is underestimated, since minor accidents not needing medical care or insurance are not recorded (Fehlberg *et al.*, 2001). Nevertheless, although the present study was carried out on a random sample of rural workers, it may also have been affected by memory and/or response biases. Memory bias because serious accidents are more likely to be remembered than minor events and the response bias because those who were injured may have been more interested in the study and in answering a questionnaire. The high frequency of workers who had suffered accidents agrees with previous reports (Giuffrida *et al.*,2001; Forastieri, 2004). Although only 16.1% considered working with animals as a high-risk task, the most frequent accidents were related to their handling, in agreement with previous reports (Waller, 1992). Agricultural workers are exposed to heavy loads and unfavorable ergonometric conditions that can lead to injuries and musculoskeletal disorders (Giuffrida *et al.*, 2001; Davis *et al.*, 2007). It makes sense then that extreme physical efforts were the second most important factor and that ''lower back pain'' was the single most important sequel form working in farming. Other physical hazards such as noise and vibration are well known sources of injuries (Giuffrida *et al.*, 2001). However, hearing protection was infrequently used. Moreover, only a third of respondents perceived noisy activities as a high risk factor. The latter was not associated with risk perceptions of those activities that can generate high intensity noise.

Half of respondents had had at least one day of absence from work averaging two months off work. Livestock activity is known to yield a high loss of working days (SRT 2005). These figures were found to be significantly higher than those reported in rural veterinarians in the region under study (Tarabla, 2009). The latter may be attributable to a real difference between the two populations and/or an underestimation among veterinarians. Self-treatments and continuous working even when suffering severe injuries have been previously reported among veterinary practitioners (Landerscaper *et al.*, 1988; Wilkins *et al.*, 2009; Tarabla, 2009). The location of lesions was consistent with results reported in farm workers in Argentina (SRT 2007). Risk factors associated with accidents were similar to those reported outside Latin America (Low *et al.*, 1996; Hwang *et al.*, 2000; Pickett *et al.*, 2003; Sprince *et al.*, 2003; Stallones and Beseler, 2003; Dimich-Ward, 2004; Hagel *et al.*, 2004; McCurdy *et al.*, 2004), with the exception of activity within the farm. Employees and casual workers were 2.7 times more likely to suffer occupational accidents that owners and managers. In the area under study, fieldwork is most often carried out by employees and casual workers. Men had 2.5 times more risk of accidents than women. On dairy farms, men are generally responsible for the toughest tasks such as disposition of abortions and corpses, neutering, vaccinations, handling tools and operating agricultural machinery, while women are responsible for managing the home, pets, poultry, milking and feeding calves.

A deep understanding of risk perceptions is important to clarify the processes by which risks are established and managed (WHO 2002). Men tend to minimize risks and to consider hazards as less problematic than women (Flynn *et al.*, 1994; Barke *et al.*, 1997; Slovic *et al.*, 1997), while women use protective elements to a greater extent and more often than men (Molineri *et al.*, 2013). Naturally, lack of protective equipment contributes to dangerous working conditions (Giuffrida *et al.*, 2001). As previously reported (Ugnia *et al.*, 2008; Molineri *et al.*, 2013), frequency of usage of these elements was independent from risk perception. Although safety practices related to operating agricultural machinery was relatively high, half of respondents did not always read the instruction manuals before usage, four out of ten do not always cover movable parts and one out of ten did not always stop the machine before checking it up. Furthermore, the uses of these practices were not correlated with each other, indicating that those who frequently practiced a particular preventive measure were actually different people. This stresses previous information that many risks are originated in individual behavior and that is the individual himself who must largely engage on their control in the work environment and also in his personal life (Royal Society 1992).

In coincidence with observations made upon in rural veterinarians in the region under study (Tarabla, 2009), gloves were the most frequently used protective element when handling abortions and corpses. It is well known that exposure to agrochemicals and pesticides is a serious threat to agricultural workers in Latin America (Giuffrida *et al.*,2001) representing a real health risk (Rodrigues and Silva, 1986; Alavanja *et al.*, 1998; Soares *et al.*, 2003). Although these work agroche-micals were visualized as high risk by 84.5% of respondents, frequency of adoption of safety practices was very low.

Frequency of *in itinere* accidents is generally higher on rural roads than on main roads (Álvarez *et al.*,1990; Tarabla, 2009). However, in agreement with previous studies (Molineri *et al.,* 2013), risk perception and use of protective devices (including those required by law such as seat belts) was lower in rural roads.

CONCLUSION

A high frequency of accidents in farming is presented. Men, employees and casual workers with many years working in farming showed the highest risk for occupational accidents. Also the

perception of these risks and the adoption of protective elements were clearly insufficient and inconsistent, so educational efforts should aim at spreading safety practices to minimize occupational hazards.

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